MISSION OPERATIONS DIRECTORATE
FLIGHT DIRECTOR OFFICE

STS-109
MISSION OPERATIONS

FLIGHT READINESS REVIEW

February 14, 2002

DA8/N. W. Hale
DA8/B. P. Austin

Agenda

• Mission Summary	**To Be Presented**
• Shuttle Flight Software	No Issues
• Flight Design & Ascent Overview	No Issues*****
• Flight Procedures	No Issues
• Joint Operations Integrated Procedures	No Issues
• Crew Training	No Issues
• Flight Controller Training	No Issues
• Significant Flight Rules	No Issues
• Special Topics	None
• Open Work	No Issues
• Network	**To Be Presented**
• USA Flight Operations	**To Be Presented**
• Readiness Statements	Included

* Back-Up Material Included

Mission Summary

Shuttle Overview

Presenter DA8/B. P. Austin

- OV-102 Columbia (first flight after OMDP)
- Crew

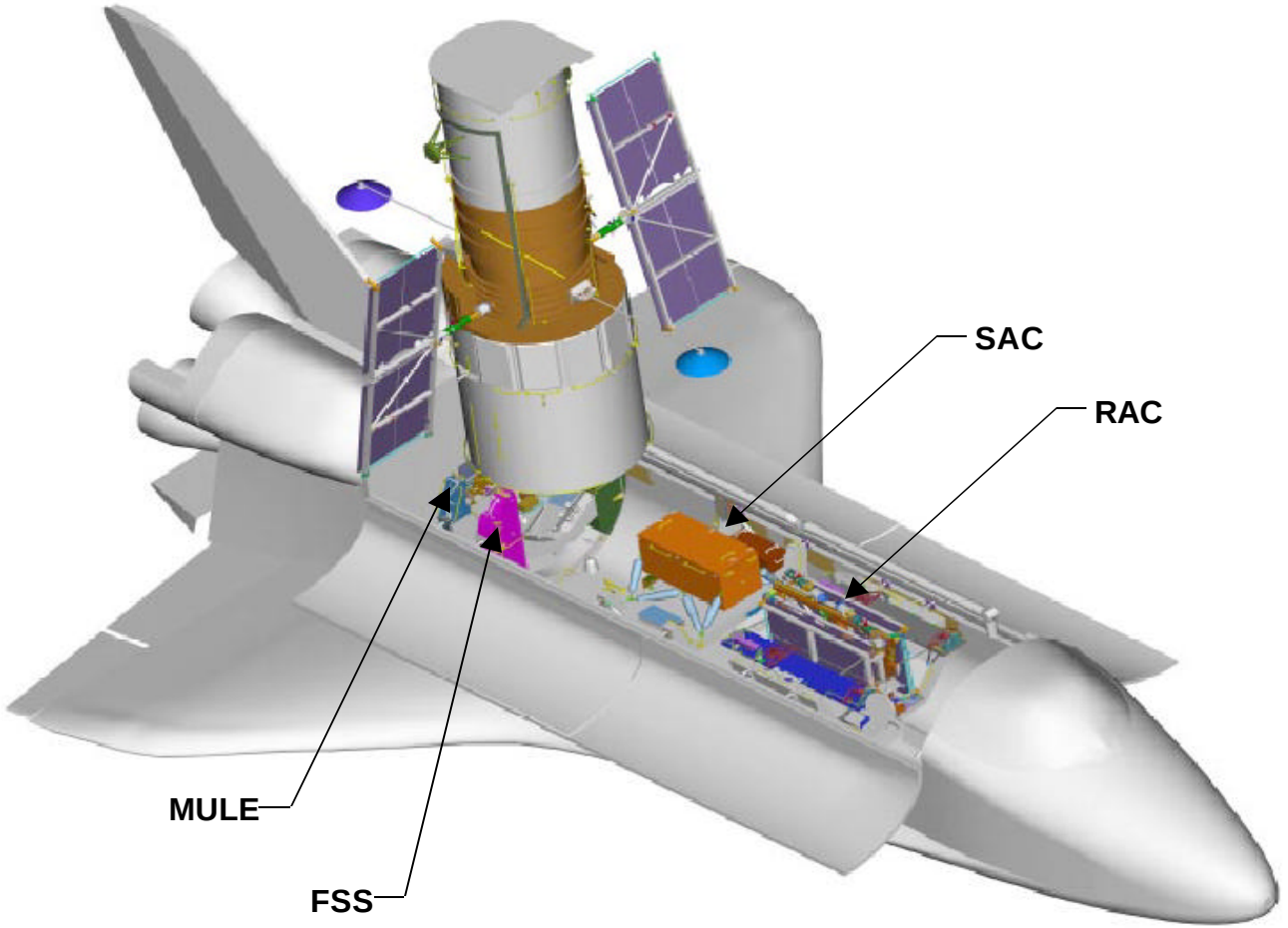
CDR	Scott Altman	MS 1/EV 1	John Grunsfeld
PLT	Duane Cary	MS 3/EV 2	Rick Linnehan
MS 2	Nancy Currie	MS 4/EV 3	Jim Newman
		MS 5/EV 4	Mike Massimino

- Launch Date 2/28/02
- Launch Window (65+ minutes) Open 11:48:14 GMT 06:48:14 EST; Close 12:54:26 07:54:26
- APM 2233 lbs (no OMS assist)
- Mission Duration 11+2
- Orbiter Software OI 28
- Landing 3/11/02, 09:39 GMT, 03:39 EST (10/20:50 MET)
- Lighting Launch-Dark, RTLS-Light, TAL-Light, EOM-Dark

Shuttle Overview

- Propulsive Consumables Summary
  - OMS/ARCS (load/margin) Loaded full/300 lbm
  - FRCS Loaded full/100 lbm
    - Protects for rendezvous at 312 n.mi, 2-2-2 deorbit protection,
      ORU jettison, HUD calibration
    - HST reboost highly desired and will be performed after last EVA if prop is available
- Non-Propulsive Consumables Summary
  - Cryo H2 (# tanks/lbs margin/launch hold) 5 / 24.5 / 73.3
  - Cryo O2 (# tanks/lbs margin/launch hold) 5 / 93.2 / 94.3
  - N2 (# tanks/lbs margin) 6 / 74.6
- LiOH
  - 45 cans (covers EOM +2)

Cargo Bay Layout



- **HST mission priorities**

	ITEM	PRIORITY	CLASSIFICATION
1.	REACTION WHEEL ASSEMBLY (#1)	1	PRIMARY
2.	+V2 SA3/DIODE BOX	2	PRIMARY
3.	-V2 SA3/DIODE BOX	2	PRIMARY
4.	POWER CONTROL UNIT (PCU)	3	PRIMARY
5.	ADVANCED CAMERA FOR SURVEYS (ACS)	4	PRIMARY
6.	NCS/RADIATOR	5	SECONDARY
7.	RATE SENSING UNIT (RSU) (R&R)	6	TERTIARY
8.	NOBL (BAYS 5 & 6)	7	TERTIARY
9.	NOBL (BAYS 7 & 8)	7	TERTIARY

Mission Overview

- FD 1 — Launch
- FD 2 — 10.2 depress, RMS & EMU checkout, HST support equipment checkout
- FD 3 — HST rendezvous, grapple, berth, solar array retraction
- FD 4-8 — EVA's 1-5
- FD 9 — HST deploy (≅ 20 min. deploy window), FSS stow, 14.7 repress
- FD 10 — Off duty, cabin stow
- FD 11 — FCS checkout, cabin stow
- FD 12 — Landing

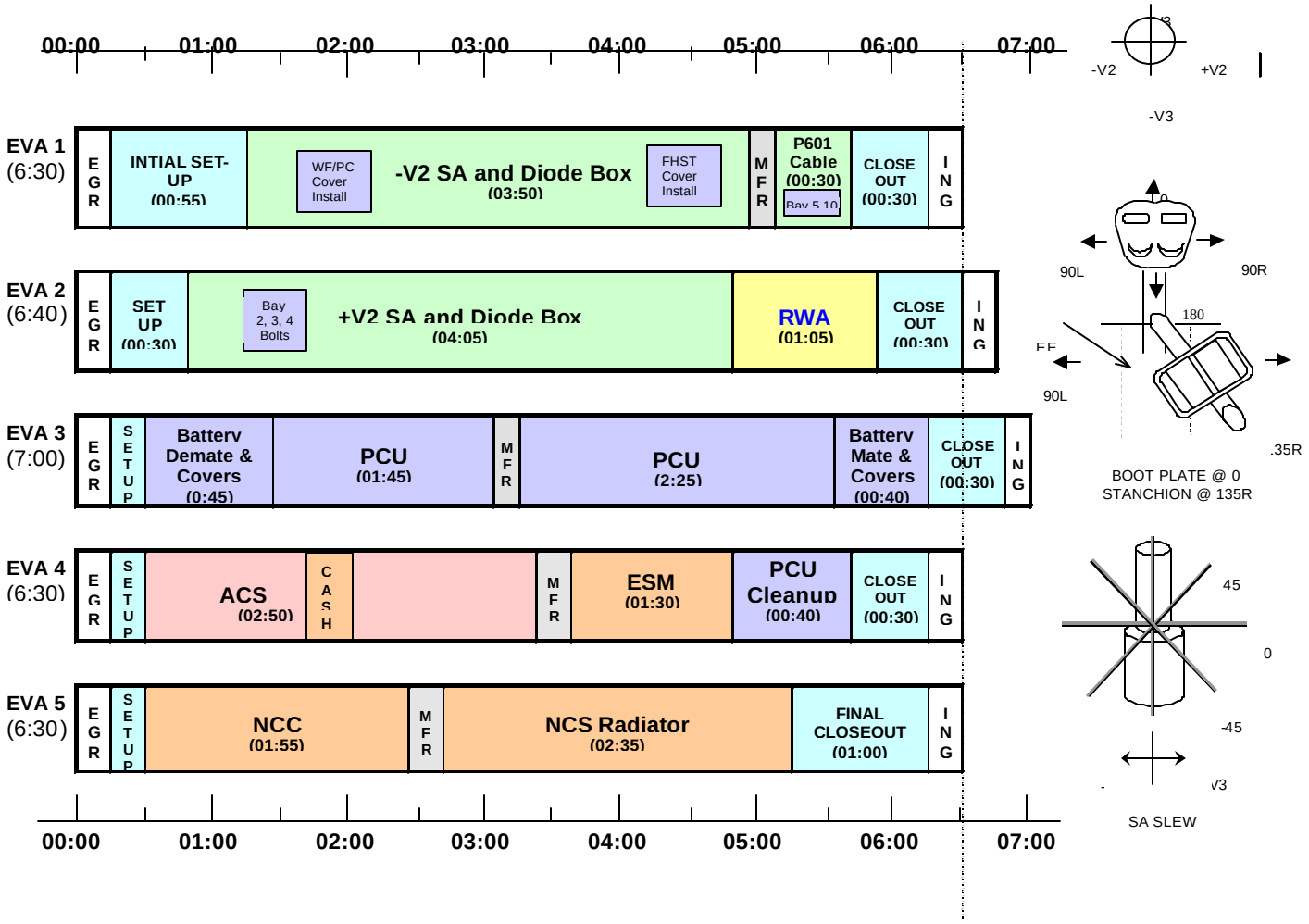
Mission Overview

- Wireless video system used in place of EVA camera for photo documentation
- “auto reboost” developed for ORU jettison, debris avoidance and HST reboost
  - Tuned to minimize loads on HST
  - Simplified technique for crew
- Solar array jettison procedure updated
  - Results in almost no EVA time loss if jettison required
  - Can be used for any other hardware jettison

EVA Overview

Presenter DA8/B. P. Austin

Date 2/01/02 | Page 7



EVA Overview

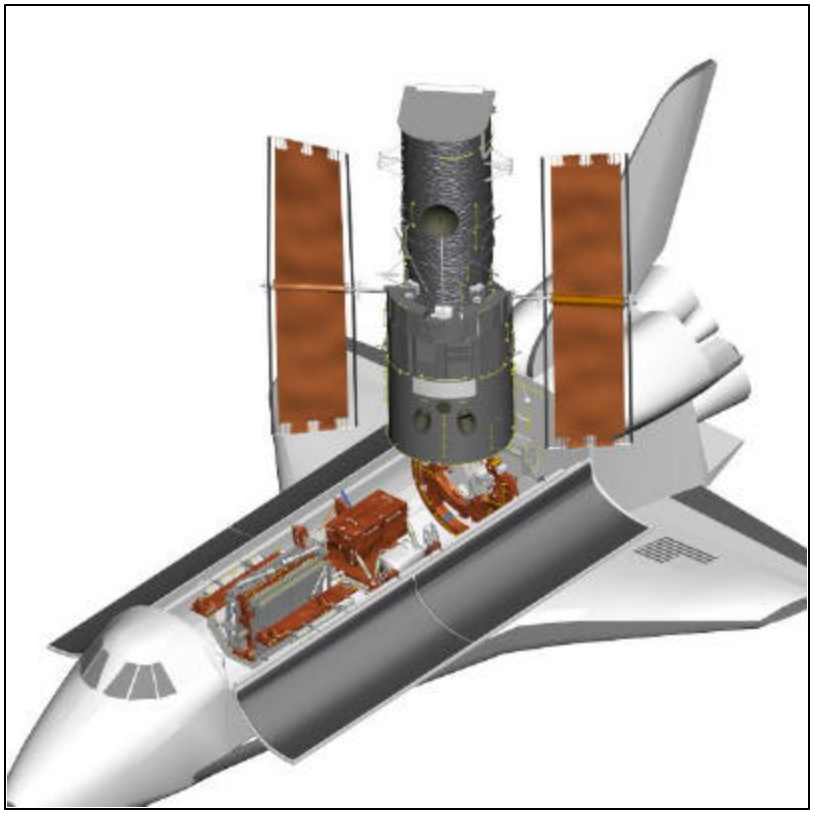
- STS-109 is the most complex and challenging of any previous HST mission and includes some of the most challenging EVA's to date
- Five (5) highly choreographed & complex EVA's
  - Two of five EVA's planned for slightly greater than 6:30
  - PCU task is spread across 4 EVA's
  - EVA breakouts on EVA's 1-3 will not leave the HST deployable overnight
- Lack of short, modular EVA tasks result in increased potential for waterfall affect to last EVA and need for a 6th EVA to complete the HST mission objectives

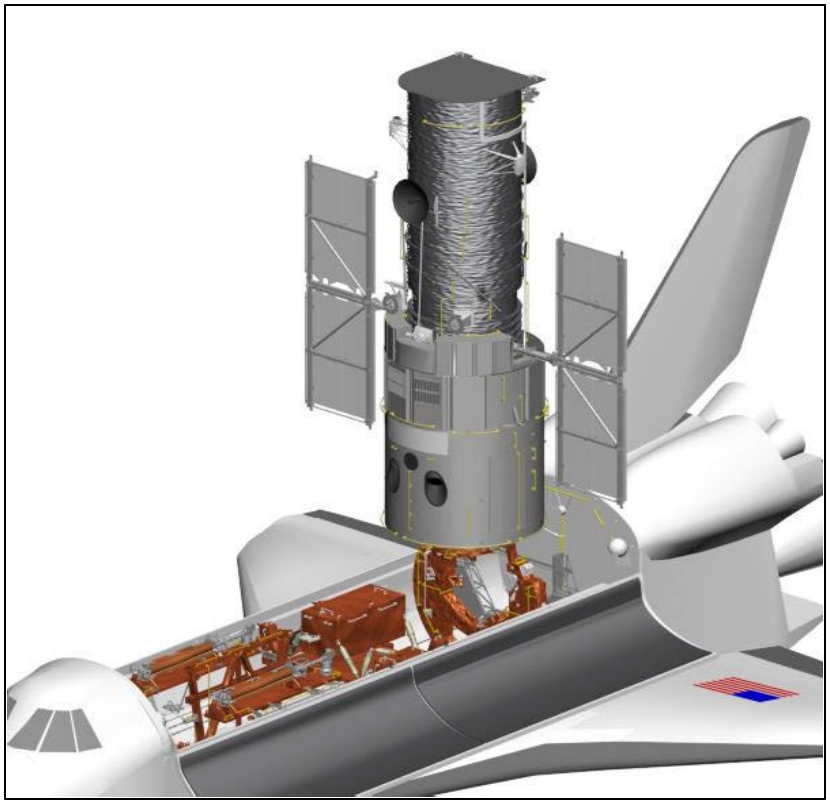
EVA Overview

- EVA task replanning guidelines defined for a reduced number of EVA's and incorporates task interdependencies
- Each case meets the HST Projects minimum mission success criteria (RWA, ACS)

	PLANNED EVA'S COMPLETED				
EVA'S REMAINING	0	1 (-SA)	2 (-SA, +SA/ RWA)	3 (-SA, +SA/ RWA, PCU)	4 (-SA, +SA/ RWA, PCU, ACS)
5	NOMINAL PLAN				
4	-SA, +SA/ RWA, PCU, ACS	NOMINAL PLAN			
3	-SA, +SA/RWA, VIKJP/ ACS	+SA/ RWA, PCU, ACS	NOMINAL PLAN		
2	RWA/ ACS, (?)	+SA/ RWA, VIKJP/ ACS	PCU, ACS	NOMINAL PLAN	
1	RWA/ ACS	RWA/ ACS	VIKJP / ACS	ACS	NOMINAL PLAN

Mission Overview





STS-109 Items of Interest

- TAL site not required for launch
  - -- Ben Guerir manned for use if required and available
- ET LOX Level Sensor Failure Procedure
  - -- Flight Rules Annex repeated from STS-108
  - -- Generic Rules change and LCC change in process
- First Low Inclination Flight Since Bermuda Closure
  - -- Use of GPS for Post-MECO navigation anomalies
- GPS Weather balloon first usage at EDW
  - -- Backup usage at KSC still in approval process
- Trajectory Server Flight following (second flight)
  - -- Mainframe (MOC) decommissioning by Oct 1
  - -- STS-110 to use Traj Server for Orbit, Entry
  - -- STS-111 to use Traj Server all phases (MOC backup)

STS-109/SM-3B
Flight Readiness Review

Networks

Agenda

- Other SN Supported Launches
- Significant Changes

Ted Sobchak
Network Director
GSFC/Code 450
February 14, 2002

Other SN Supported Launches

- Two SN supported launches are scheduled in the STS-109 mission timeframe:
  - AtlasIII/ECHOSTARVII – February 21, 2002
  - AtlasII/TDRS-I – March 08, 2002
    - The following sites used by Shuttle are also used by TDRS-I :
      - Diego Garcia, MILA, Wallops
- No Network resource conflicts expected, scheduling coordination will continue.

Significant Changes

- **MILA and PDL**
  - **Software delivered and tested for the Best Source Select (BSS) system. BSS is used during ascent to select telemetry from several ground station sources.**
    - **Eliminates intermittent erroneous BSS switching by adding an additional logic statement to the decision algorithm**
  - **New GPS Timing system installed at PDL**
    - **Cesium Frequency standard (NME) and Loran-C remain as backup**
- **Space Network**
  - **TDRS-8 drifted to 171°W, co-located with TDRS-7; not operational for this mission.**
- **DOD Radars**
  - **CMTC remains down for relocation until April 15, 2002 – No Impact.**

Significant Changes

- **NISN**
  - **Tail Circuits**
    - **18 “unresolved” circuits that do not have owners have been blocked until STS-109 WOW. They will then be disconnected.**
    - **Extensive coordination and mission testing has been performed to ensure that a mission capability has not been compromised. Additionally, a high inclination Launch Simulation is scheduled that maximizes Network loading.**
  - **Voice Compression**
    - **30 mission voice loops have been compressed at 24 Kbps for the last three Shuttle missions.**
    - **A total of 771 mission voice loops have been compressed for this mission.**
      - **Air-to-Ground Voice and TV Conference will not be reconfigured for this phase.**

Space Communications and Data Systems

Certificate of Readiness

Pending completion of flight readiness preparations, remaining standard work and closure of all action items, NASA dedicated elements and all CSOC resources are ready to support the STS-109/Hubble Space Telescope (HST) Servicing Mission (SM)-3B

(Original Signed By)

P. E. Liebrecht **Date**
Associate Director, Program Manager for Mission Services
Goddard Space Flight Center

(Original Signed By)

G. Morse **Date**
Manager, Space Operations Services
Johnson Space Center

(Original Signed By)

D. Tighe **Date**
CSOC Program Manager

	Presenter: L. S. Bourgeois
	Organization/Date: Flt Ops/Date:2/14/02

STS 109
Flight Readiness Review
2/14/02

USA Flight Operations

AGENDA

Presenter:
L. S. Bourgeois
Organization/Date:
Flt Ops/Date:2/14/02

- Facilities Readiness
- Out of Family - None
- Special Topics - None
- CoFR Statement

FACILITIES READINESS

Presenter:
L. S. Bourgeois
Organization/Date:
Flt Ops/Date:2/14/02

- Mission Control Center (MCC)
  - Software - No significant software changes since STS -108
  - Trajectory Services Upgrade (TSU)
    - TSU to be flight following in the Ops Certified environment
      - Same environment that will be used when TSU is primary system
      - STS –110 will be first flight for TSU prime for On-Orbit and Entry
      - STS – 111 Will be first flight for TSU prime for Ascent

FACILITIES READINESS

Presenter:
L. S. Bourgeois
Organization/Date:
Flt Ops/Date:2/14/02

- MCC Applications Configuration Management (CM)
  - During STS-108 incorrect version of cmd_track history application found in the Operations Certification Directory
    - CM Escape
  - Have implemented additional CM controls since STS–108
  - Audited all Applications Files, 9012 files audited
    - 10 required new authorization forms, certification files were complete
    - 2 files re-certified
    - 5 files (singe application) required waiver, legacy from development contractor
  - For all missions FO will perform L-30 and L-7 Audits
    - Had previously been conducted for Flight Design Applications will now be performed for all Applications
    - Audit conducted by development organization with QA oversight
  - MCC Applications Software will be locked down at L-30
    - Mission Manager approval required to unlock
    - Any unlock after L-7 will require additional audit

STS-109
Certification of Flight Readiness

Presenter:
L. S. Bourgeois

Organization/Date:
Flt Ops/Date:2/14/02

- The USA Flight Operations FRR, NASA MOD FRR, and USA SFOC Pre-FRR have been completed
- All Contractor Accountable Functions (CAF) have been completed, or are scheduled for completion, in accordance with NASA requirements and the applicable portions of the Space Flight Operations contract Flight Preparation Process Plan (NSTS 08117, section 8.5.18 and appendix “R”).
- All required products have been or are scheduled to be delivered per requirements.
- All Facilities have been configured and are ready for mission support.
- All CAF personnel are trained and certified or will be trained and certified prior to flight.
- Flight crew has been trained.
- There are no open issues.
- Pending completion of the defined open work.

USA FLIGHT OPERATIONS IS READY
TO SUPPORT THE STS 109 MISSION

L. S. Bourgeois
Director, Mission Operations

United Space Alliance

MISSION OPERATIONS DIRECTORATE
SHUTTLE CERTIFICATE OF FLIGHT READINESS (CoFR)
FLIGHT: STS-109/HST REQUIREMENTS

Critical Processors/Applications, Non-Crit Processors/Applications; Flight Rules: EMCC: Trng-MCC /POCC; FTP-New Operations; Anomaly-Proc; Ex/AI from Prior Reviews; CIL/Hazards; No Constraints; Level II Actions; Mission Requirements; Exception Resolution; CMD Proc; FPPP Requirements Met; Contractor Process Insight	DA8/Chief, Flight Director Office
Crit Processors/Applications; Non-Crit Processors/Applications; FDF; EMCC; TRNG-MCC/POCC; LCC; FTP-New Ops; Flight Anomaly Resolution; Anomaly-Proc; Ex/AI from Prior Reviews; CIL/Hazards; No Constraints; Level II Actions; Mission Requirements; Engineering Drawings; CMD Proc; FPPP Requirements Met; Contractor Process Insight	FOR RICK FITTS DF/Chief, Systems Division
Crit Processors/Applications; Non-Crit Processors/Applications; FDF; EMCC; RECON-Flight S/W (MMU); TRNG-MCC/POCC; FTP-New Ops; Flight Anomaly Resolution; Anomaly-Proc; Ex/AI from Prior Reviews; No Constraints; Level II Actions; Mission Requirements; CMD Proc; FPPP Requirements Met; Contractor Process Insight	DM/Chief, Flight Design and Dynamics Division
Crit Processors/Applications; Non-Crit Processors/Applications; FDF; FDF Manage; EMCC; PGSC; TRNG-MCC/POCC; FTP-New Ops; Flight Anomaly Resolution; Anomaly-Proc; Ex/AI from Prior Reviews; CIL/Hazards; No Constraints; Level II Actions; Mission Requirements; Engineering Drawings; CMD Proc; FPPP Requirements Met; Contractor Process Insight	FOR L. D. DAVIS DO/Chief, Operations Division
EX/AI from Prior Reviews; No Constraints; Level II Actions; Mission Requirements; FPPP Requirements Met; Contractor Process Insight	DT/Chief, Space Flight Training Division
FPPP Requirements Met; Contractor Process Insight	DV/Chief, Advanced Operations & Development Division
FAC-NBL; FAC-SVMF; FDF; TRNG-Crew Trng; TRNG-MCC/POCC; TRNG-EVA/MARS; LCC; FTP-New Ops; Flight Anomaly Resolution; Anomaly-Proc; Ex/AI from Prior Reviews; CIL/Hazards; No Constraints; Level II Actions; Mission Requirements; Engineering Drawings; CMD Proc; EVA Hardware Integration; Contractor Process Insight	for DX/Chief, EVA, Robotics, & Crew Systems Operations Division
FAC-MCC; FAC-Network Interface; FAC-SMS; FAC-SPF; FAC-IPS ; Crit Processors/Applications; Non-Crit Processors/Applications; FD-Trajectory; FD-Consumables; FD-PDRS; FD-Analyst Cert; FD-CTF; FDF Manage; EMCC; RECON-STAR/MASTII/CD ROM Products; RECON-MCC; TRNG - Crew Trng; TRNG-MCC/POCC; TRNG-SMS; FTP-New Ops; Flight Anomaly Res; Anomaly-Proc; Ex/AI from Prior Reviews; CIL/Hazards; No Constraints; Level II Actions; Mission Requirements; Engineering Drawings; Exception Resolution; CMD Proc; FPPP Requirements Met	Associate Program Manager, Flight Operations, SFOC
EMCC; NETWORK; Flight Anomaly Resolution; Anomaly-Proc; Ex/AI from Prior Reviews; No Constraints; Level II Actions; FPPP Requirements Met	2/1/02 Network Director, Shuttle, GSFC
	Mission Operations Director

STS-108/UF1 FLIGHT READINESS STATEMENT

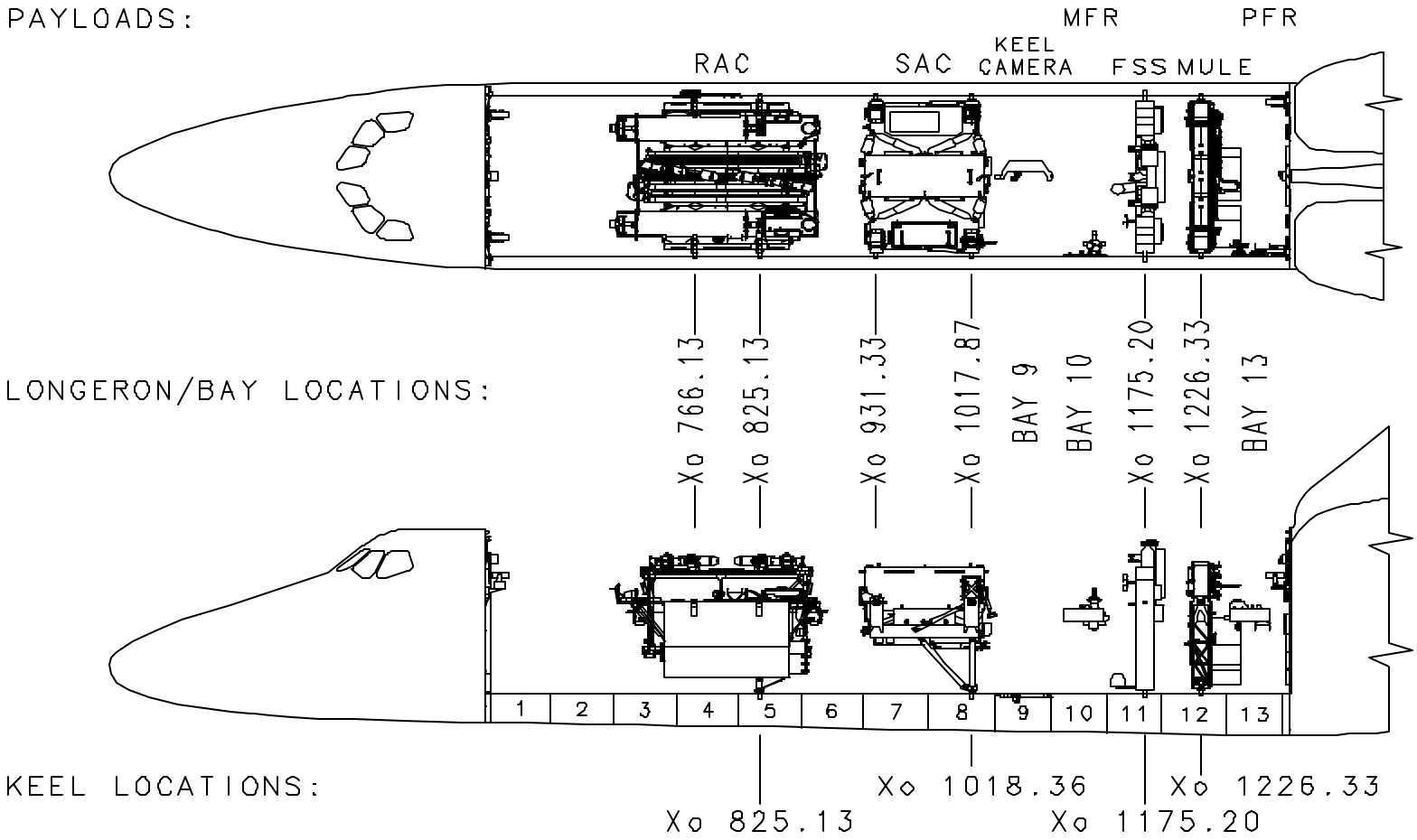
THE MISSION OPERATIONS FLIGHT PREPARATION PROCESS PLAN DOCUMENTED IN NSTS 08117, REQUIREMENTS AND PROCEDURES FOR CERTIFICATION OF FLIGHT READINESS, HAVE BEEN SATISFIED. REQUIRED PRODUCTS AND OTHER RESPONSIBILITIES FOR MISSION OPERATIONS (NSTS 08117, SECTION 8, PARAGRAPH 8.5.7) HAVE BEEN OR WILL BE PRODUCED OR COMPLETED. ALL AREAS ARE READY. MISSION OPERATIONS IS PREPARED TO SIGN THE CERTIFICATE OF FLIGHT READINESS FOR STS-109/HST.

J.M. Hefin
MISSION OPERATIONS DIRECTOR

C. L. VERMILYEA
VICE PRESIDENT AND ASSOCIATE
PROGRAM MANAGER, FLIGHT
OPERATIONS, SPACE FLIGHT OPERATIONS
CONTRACT

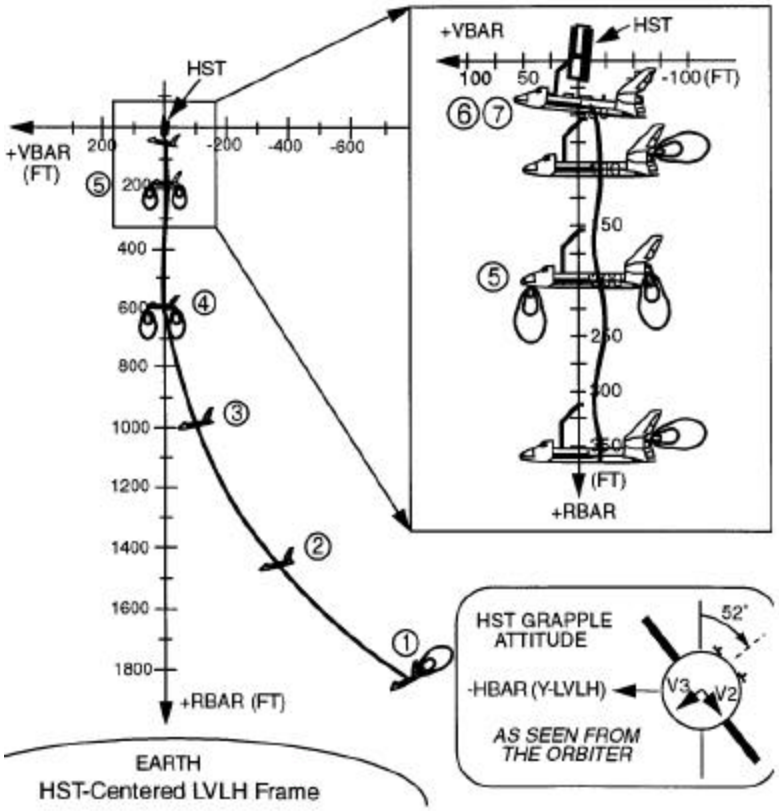
Back-Up Charts

Cargo Bay Layout



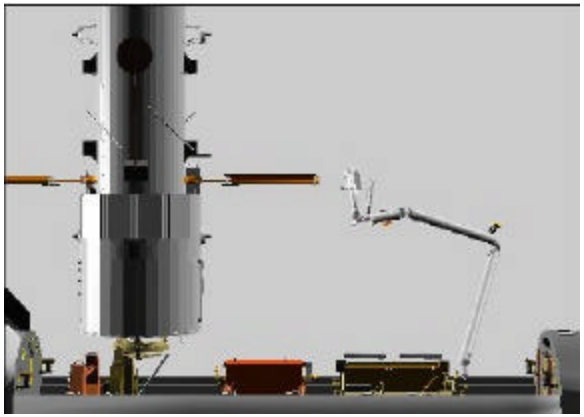
Rendezvous manual phase Rbar profile

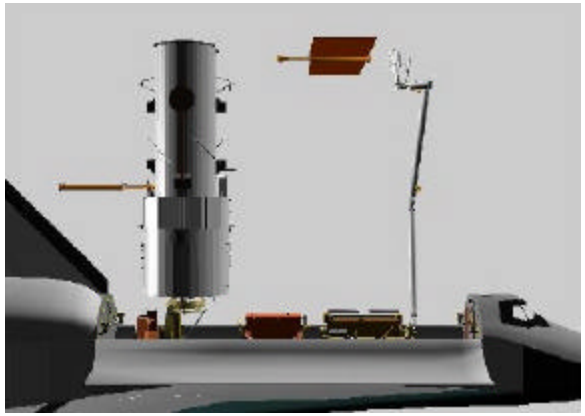
	Approx. PET (min)	EVENT
1	0	MANUAL PHASE TAKEOVER AT MC4 (Rdot = -3.0 fps)
2	3	1500 FT BRAKING GATE (Rdot = -2.3 fps) **SWITCH TO LOWZ**
3	8	1000 FT LOWZ BRAKING GATE (Rdot = -1.5 fps)
4	13	600 FT GATE (Rdot = -0.8 fps) Allow Rdot to drop to -R/1000
5	31	200 FT GATE (Maintain Rdot = -0.2 fps)
	38	120 FT GATE (Let Rdot drop to -0.1 fps)
6	50	**INRTL** When Aligned
	50	35 FT Grapple Position (Final LOWZ Braking)
7	52	Stabilize and Grapple (Sunset+3 minutes)



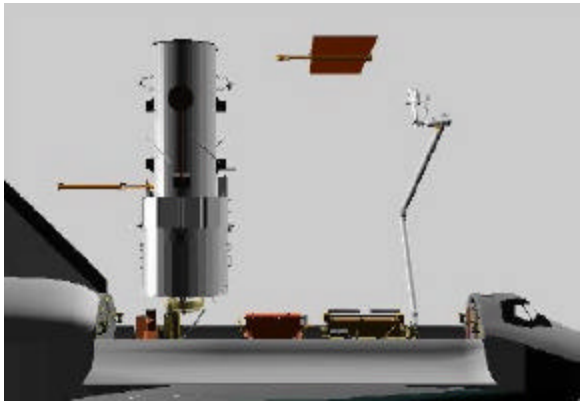
RMS/EV Orientation for SA-II Jettison & Separation

Solar Array Removal





Solar Array Release

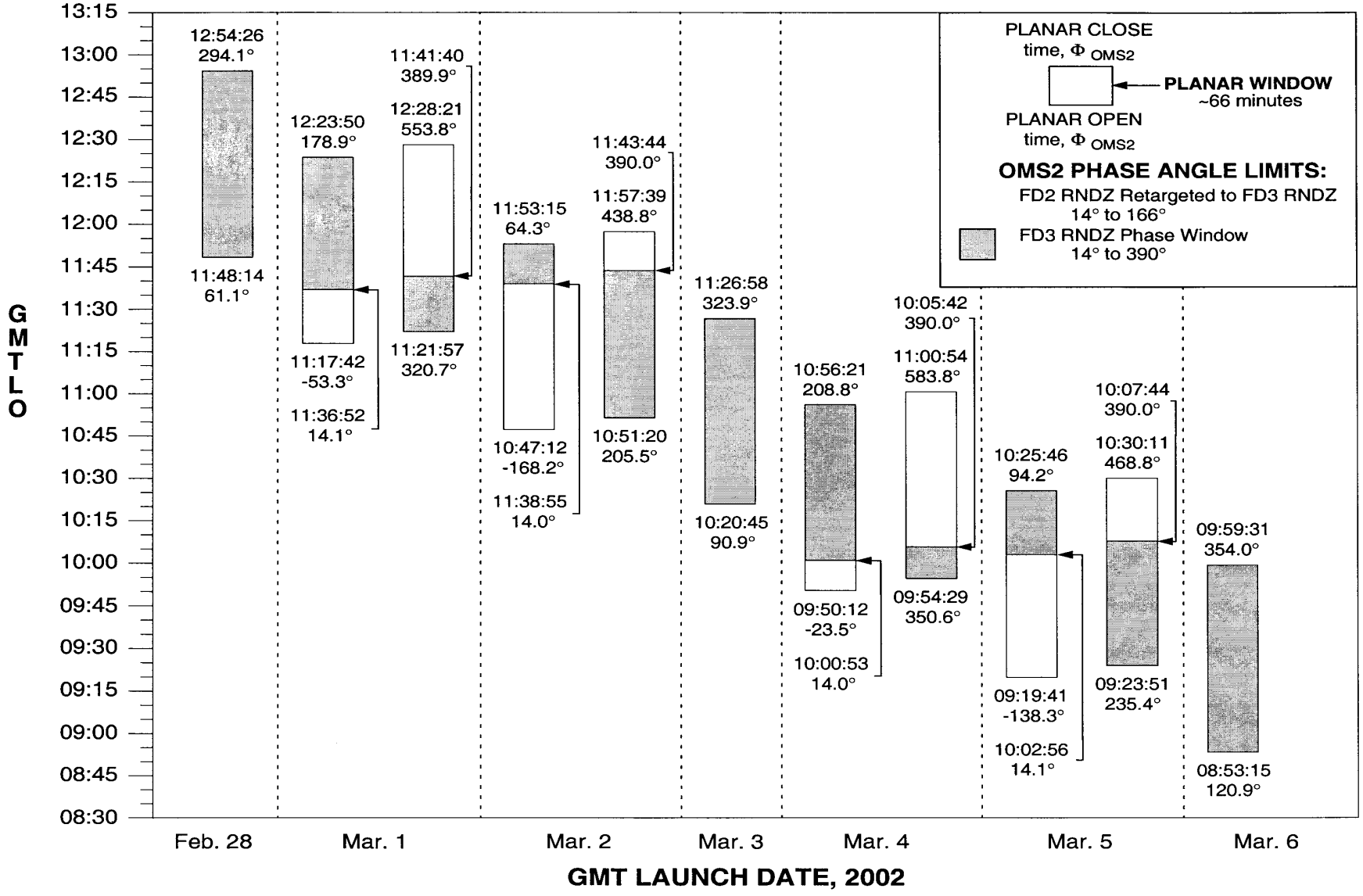


Solar Array Separation Burn

Mission Duration = 11+2
Inclination = 28.45°
OMS2 ha/hp = 310 x 95 nmi.
Target ha/hp = 317 x 307 nmi.

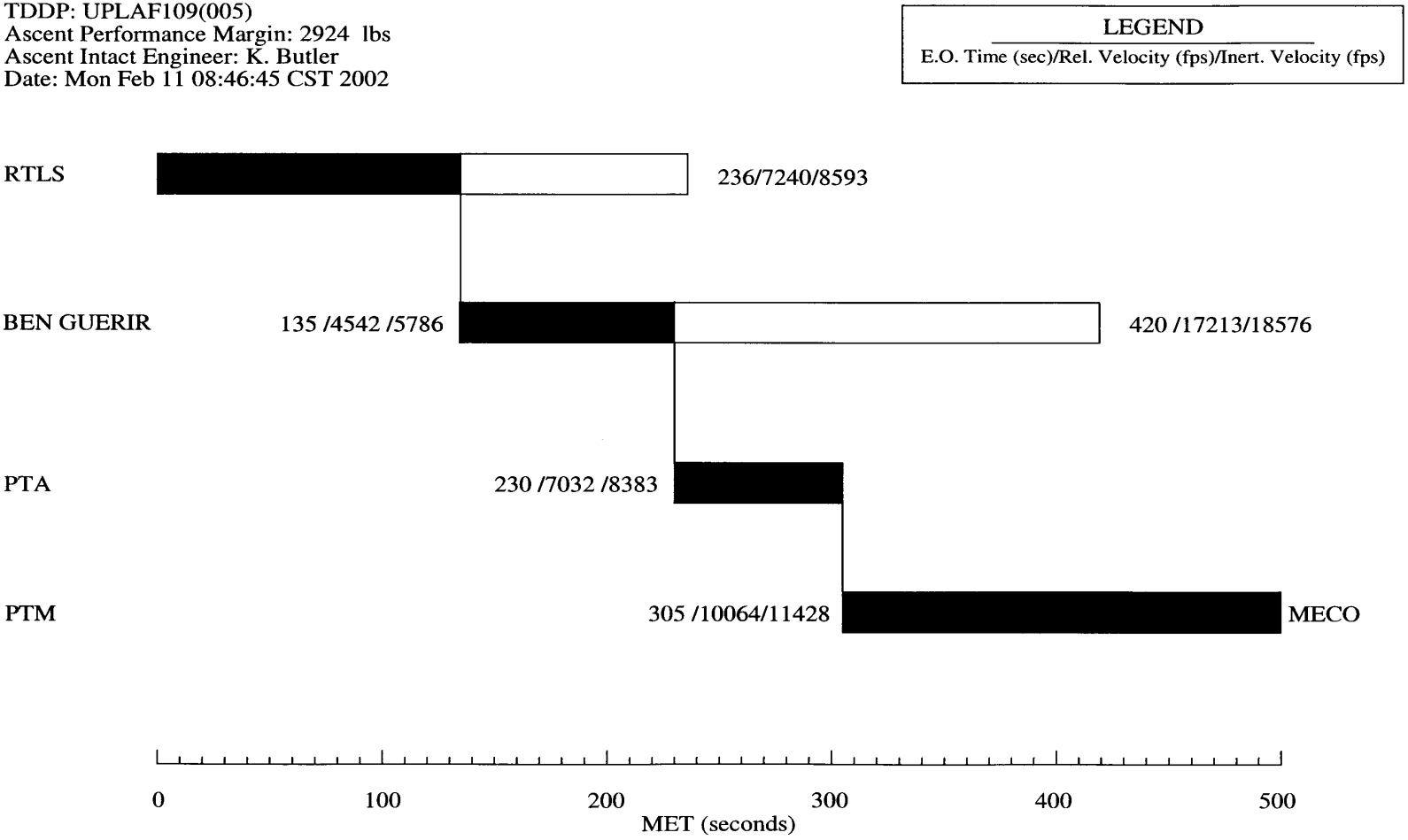
STS-109 LDP
DAILY PLANAR / PHASE WINDOW

C. Osgood/USH-483L
J. LoPresti/USH-483L
January 28, 2002



STS 109 FRR ABORT REGIONS CHART

TDDP: UPLAF109(005)
Ascent Performance Margin: 2924 lbs
Ascent Intact Engineer: K. Butler
Date: Mon Feb 11 08:46:45 CST 2002

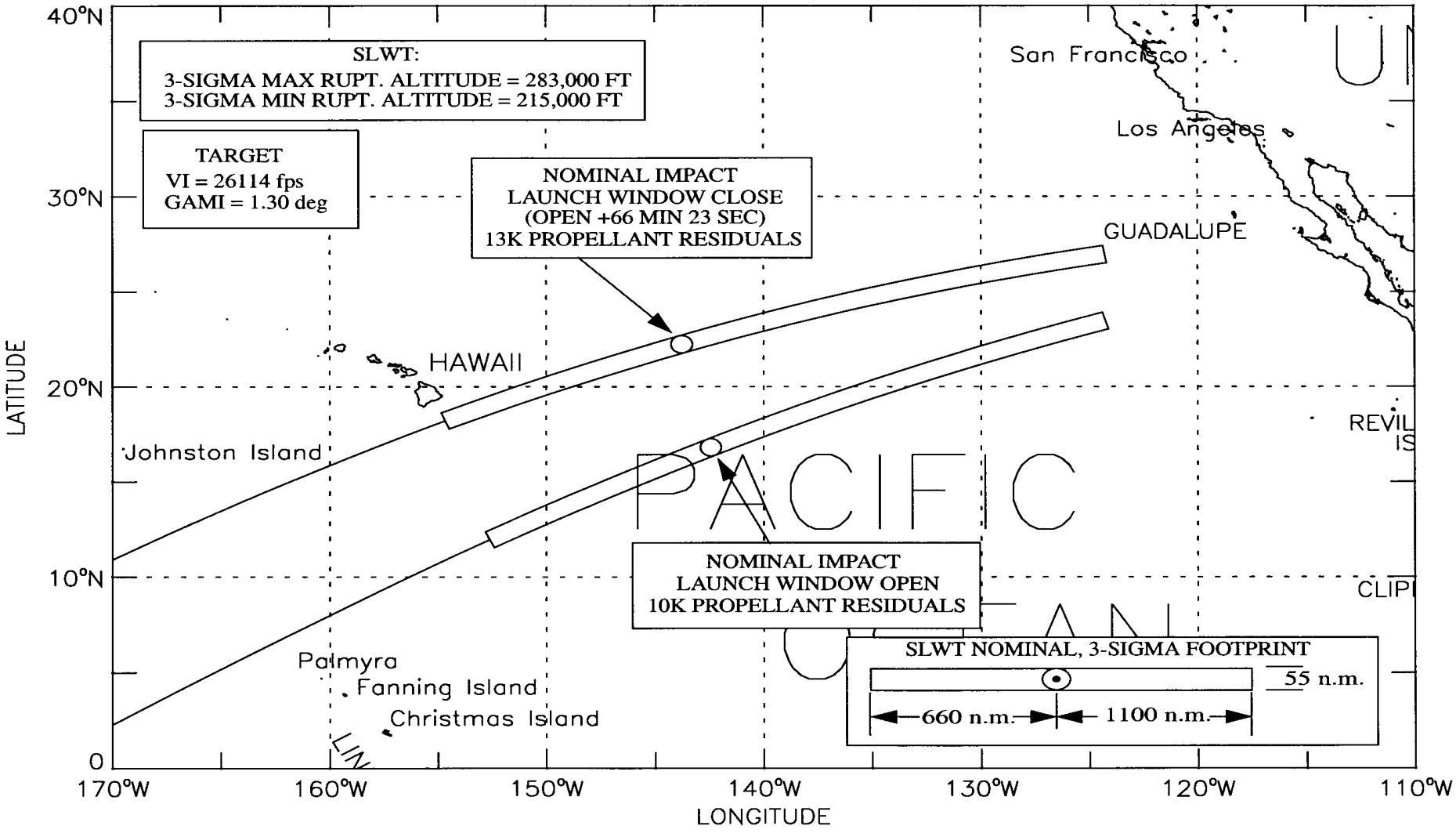


A Boeing thermal assessment certified the Last RTLS third peak heating to the performance boundary and approved by the 1/17/02 PRCB.
Late BEN boundary is based on +/- 50 deg Beta constraint. Note: All boundaries are verified using TDDP# UPLAF109(005) and are shown at open of the launch window.

Note: Due to inherent assumptions made in its creation, this chart may not accurately depict DOL conditions and intact abort boundary times.

Nominal ET Impact Area

STS-109



STS-109/HST (SM)-3B
Mission and Data Services